Social groups and their technological styles

SOCIAL GROUPS AND THEIR TECHNOLOGICAL STYLES- TOWARDS AN EXPLANATION OF THE DEVELOPMENTAL PROCESS OF BAKELITE

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For a social constructivist analysis of technological artefacts, the convergence of historical and sociological studies of technology seems to be a crucial first step. In a recent workshop, different strategies were discussed to render such a convergence successful (1). Amongst those: the necessity to 'open the black boxes' of technological development, to give a 'thick description' of cases and to combine strategical 'research sites' (such as controversies, laboratories, governmental advisory commissions) to include the various elements relevant to an understanding of technology. Obviously, this implies the risk of drowning in a sea of complexities. To survive, concepts must be developed in order to simplify things again. Pinch and Bijker (1984) have proposed an integrated social constructivist approach towards the social study of science and technology which offers such a set of heuristical, analytical concepts. In this paper I will focus on the third stage of their approach. In that stage, the task is to relate the content of a technological artefact to the wider sociopolitical milieu. More specifically, I shall concentrate on developing some theoretical concepts to 'simplify' the complex relationship between social groups and the content of technological artefacts (Pinch and Bijker, 1984, p. 428-9).

The key requirement in identifying social groups is whether the members of such a group share a rather homogeneous meaning, given to the specific artefact (Pinch and Bijker, 1984, p. 414-5). With respect to the social groups of engineers and technicians, I shall denote the frame of reference which underlies this homogeneous meaning as 'technological style'. By implication, a technological community (i.e. a social group with special professional and disciplinary bonds with technology) and its corresponding technological style define each other. A technological style comprises cognitive as well as social elements, since both may equally well affect the meaning which is given to an artefact. Thus, the various aspects of a technological style include formal scientific theories, tacit knowledge, design methods and criteria, specialized testing procedures, norms and values, and social, cognitive and technical goals.

The history of Bakelite may illustrate the use of the concept 'technological style'. Bakelite is generally viewed as the starting point of the 'plastic age'. It was patented in 1907 by Leo Hendrik

Baekeland, who was born in Ghent in 1863 and got his PhD from the University of Ghent in 1884 (sic!). One of the questions with respect to the historical development of synthetic plastics is, why the 'invention' of Bakelite occurred not earlier than in 1907, while all necessary knowledge and techniques were available since 1883. This can be partly explained by using the concept 'technological style'. Several chemists had observed the condensation reaction between phenol and formaldehyde, resulting in a resinous product. However, nobody had thought of putting it to use as a plastic. This is not because there was no demand for plastic materials. In the 1870-s and 1880-s some social groups did perceive the need for new plastics, which led to the development of cellulosenitrate plastics - in particular Celluloid. But after the stabilization of Celluloid, some problems remained: the safety problem of Celluloid induced active research to construct a less inflammable plastic and the high price of camphor stimulated the search for other solvents. A plausible explanation for the negligence of the practical possibilities of the phenol-formaldehyde resin by scientists such as Bayer, Kleeberg, Manasse and Lederer lies in their respective technological styles. Within those technological styles it simply was not recognized as a problem. Such a sticky mass was either a non-analysable substance, and hence to be dismissed, or it was something to be avoided deliberately when heading for another product (Bijker, 1984).

Then, around 1900, there were some chemists who deliberately tried to make a Celluloid substitute out of that phenol-formaldehyde condensation product. To explain why those chemists failed where Baekeland in 1907 succeeded, I need the concept 'inclusion in a technological style'. Very shortly, the argument runs as follows (for a more extensive account, see: Bijker, 1984). Both the groups of 'failing' chemists and Baekeland were working according to the technological style of the 'celluloid-chemists'. However, chemists such as Smith, Story, Fayolle, Luft were higher included than Baekeland: they were thinking and working more closely along the lines of the celluloid technological style; more specifically: they all viewed the problem of making a useful plastic out of the phenol-formaldehyde resin as a problem of finding the right weakening solvent. To come up with a radically different variant of solution, somebody was needed with a lower inclusion in this technological style. Baekeland started, it seems, his research on this problem by also looking for an adequate solvent. But then he moved on to a type of research which was much more in line with the technological style in which he previously had worked: a systematic study of all reaction variables, specifically aiming at controlling the reaction at an industrial scale. More generally, I want to argue that people in positions characterized by a low inclusion in the relevant technological style generate other types of variants than people in positions characterized by a high inclusion. To be more specific, actors on positions characterized by a high inclusion are expected to generate variants which leave the basic scheme of an artefact unchanged: optimalizations, adaptations. On the other hand, actors with a low inclusion in the relevant technological style are more likely to generate radically new variants.

If the concepts 'inclusion' and 'technological style' do not allow for more than the previous rephrasing of the marginality-thesis, their 'simplifying' power would be very weak. However, there is more to it, when these concepts are combined with the descriptive concepts 'selection', 'variation' and 'stabilization' (Pinch and Bijker, 1984). The combination of different social groups/technological styles and varying degrees of inclusion offers a framework which enables us to differentiate between various construction processes of artefacts without falling back into either the old dichotomies (between, for example, internal and external) or the simple linear models (for a critique on those, see: Pinch and Bijker, 1984). This may be illustrated by demonstrating what would constitute an explanation in a research strategy along these lines. The following is a model of a theoretical statement:

> 'under specific conditions certain distinctive types of selection, variation and stabilization processes are more likely to occur than other types'.

The 'conditions' are to be specified in terms of the (number of) relevant social groups and the inclusion of the actors.

Thus, hypotheses may be formulated linking different types of scientific and technological change to different socio-cultural situations. Using the notions of social groups and technological style, I will distinguish three types of developmental processes of artefacts. These are: (1) no distinct technological community/style can be identified as relevant to the developmental process; (2) relevant to the developmental process is only one technological community with corresponding style; (3) relevant to the developmental process are more technological communities/styles (Bijker, 1983). This creates a kind of grid which, together with the proposed format for a theoretical explanation, promises to have enough 'simplifying power' to bring some order in the rich and complex data produced by the most recent social studies of technology.

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